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Terrestrial snails (Gastropoda: Pulmonata) from Writing-on-Stone Provincial Park, Alberta, Canada

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Abstract: There are few studies on the terrestrial molluscs of the Great Plains of Alberta. Nearly all previously published surveys have focused on the faunas of the Rocky Mountain Foothills, the Cypress Hills, the Parklands of Central Alberta, or the boreal forests. By means of hand-picking and litter samples, we surveyed for the first time the terrestrial snail fauna in the Writing-on-Stone Provincial Park, southern Alberta, Canada. From among the hoodoos (weathered rock formations) and along the cliffs on the north side of the Milk River, we found terrestrial snails at four of our five sites within the hot, dry valley of the river. Our study confirms our assumptions that the terrestrial snail fauna in these hostile habitats lacks diversity.

Key words: Mollusca, land snails, Succineidae, *Vallonia gracilicosta*, *Pupilla blandii, Discus shimekii,* species' inventory, Great Plains

INTRODUCTION

From a malacological viewpoint, Alberta, at the western edge of the Great Plains is of interest as an area of possible transition between the terrestrial mollusc fauna of the Canadian Prairies and the western Cordillera. Relatively little has been published on the Alberta terrestrial malacofauna. Much of what is known is in literature now over 60 years old (Dawson 1875; Taylor 1893, 1895; Pilsbry 1899; Berry 1922; Mozley 1926a, 1926b, 1930, 1934; Russell 1951). More recent publications were the results of research into gastropods as intermediate hosts of nematode parasites of ungulates (Platt 1980; Van Es and Boag 1981; Boag and Wishart 1982; Samuel et al. 1985; Locasciulli and Boag 1987; Robb and Samuel 1990), were mainly methodological (Boag 1985, 1990), or focussed on the population structure of a boreal fauna (Kralka 1986). A few other papers offer individual species' records (Harris and Hubricht 1982) or species' lists for southern Alberta (Harris and Pip 1973; Harris 1978). However, at least some of this work is beset with doubtful or erroneous identifications and the terrestrial malacofauna of Alberta, and particularly on the plains, remains poorly known. During 2008 and 2009, surveys were made for terrestrial molluscs in southern Alberta that focused on potentially at-risk taxa (i.e., *Oreohelix* spp.) but also included more general faunal surveys. The purpose of this study was to survey the terrestrial Mollusca within Writing-on-Stone Provincial Park, along the Milk River, in southern Alberta. To our knowledge, there are no previous collections of terrestrial molluscs from this park.

MATERIALS AND METHODS

Study Area

The study area lies in the Great Plains and is classified within the Mixed Grasses ecoregion of the National Ecological Framework for Canada. The Mixed Grasses ecoregion, part of the larger Prairie ecozone, is semi-arid short-grass prairie dominated by a variety of grasses and sagebrush. Trees are few, scrubby in appearance, and restricted to shaded valley slopes and river bottoms. The mean precipitation is 250–350 mm annually (Ecological Stratification Working Group 1995).

Writing-On-Stone Provincial Park is about 100 km southeast of Lethbridge, Alberta, Canada (Figure 1). The park is 2689 ha in area and straddles the Milk River. It includes badlands, riparian habitat, and xeric grasslands (Alberta Parks 2013). The five south-facing sites sampled were along the north side of the Milk River, within or near the park's campground and west along the Hoodoo Trail that runs along the base of a weathered sandstone cliff (Table 1; Figures 2 and 3). Sites were selected for availability of suitable microhabitats (i.e., abundance of leaf litter). Sites along the Hoodoo Trail lacked any large trees. Site 2 had dense shrubs and some larger trees. Below and among the sandstone cliffs and hoodoo formations are sandy and silty loam regosols that are base-rich (pH 7.9–8.5; Greenlee 1984).

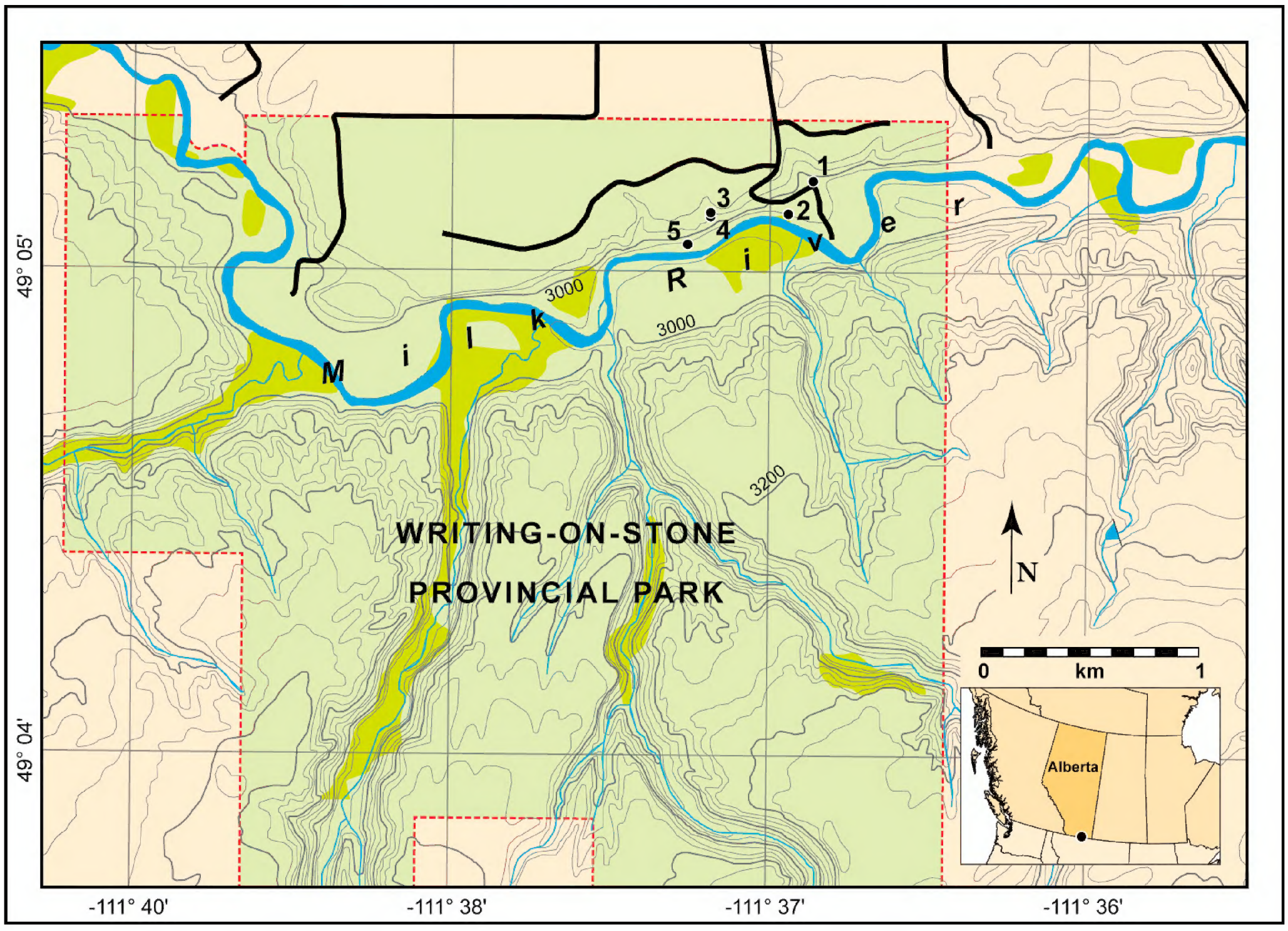


Figure 1. North portion of Writing-on-Stone Provincial Park showing location of survey sites. Contour lines are in 25 ft. (7.6 m) increments. Map inset shows location of Writing-on-Stone Provincial Park within Alberta and western Canada. The provincial park is shown as pale green with red, dashed border; roads are represented as thick, black lines and wooded areas as bright green patches.

Data Collection

Data and specimen collection were done on 20 August 2009, under permit provided by the Parks Division of the Alberta Ministry of Tourism, Parks and Recreation (Research and Collection Permit No. 09-035). A hand-held GPS (Garmin 12CX) was used to record geopositional data (datum: NAD83). Elevations of sites were between ca. 900 and 930 m above sea level.

Specimens were collected by hand and/or by collecting handfuls of leaf litter and soil from suitable microhabitats. Litter samples of approximately 1–2 L were placed into plastic bags. These samples were later dried and sieved to remove the coarsest material. Snails were then picked out by hand from the remaining fine material. No lens or microscope was used but careful and methodical sorting recovered all size classes of snails.

Identifications were made using Pilsbry (1948), Gerber (1996), Forsyth (2004), Nekola and Coles (2010), and Nekola et al. (2014). References used for identification, as well as the citation of the original description of each species are included below. Suprageneric classification follows Bouchet and Rocroi (2005). All specimens are

Table 1. Sample sites within Writing-on-Stone Provincial Park, with species found and numbers of specimens from each site. All collections were made on 20 August 2009. Abbreviations: H, hand collected; LS, litter sample.

Site	Geographic Coordinates (NAD83)	Sample type	Species, number of specimens, voucher catalogue number			
			Vallonia gracilicosta	*Pupilla blandii*	*Unidentified succineid*	*Discus shimekii*
1	49°05.052′ N, 111°37.038′ W	LS *	—	—	—	—
2	49°04.943′ N, 111°37.132′ W	LS	3 (RBCM 014-00214-004)	2 (RBCM 014-00215-001)	1 (RBCM 014-00215-002)	28 (RBCM 014-00215-003)
3	49°04.946′ N, 111°37.425′ W	LS	33 (RBCM 014-00216-001)	25 (RBCM 014-00216-002)	1 (RBCM 014-00216-003)	—
4	49°04.936′ N, 111°37.424′ W	LS/H*	7 (RBCM 014-00217-001)	1 (RBCM 014-00217-002)	1 (RBCM 014-00217-003)	—
5	49°04.867′ N, 111°37.511′ W	LS	16 (RBCM 014-00218-001)	—	1 (RBCM 014-00218-002)	—

*No snails in litter sample.

2

3

Figures 2 and 3. Cliff and hoodoos along Hoodoo Trail, Writing-in-Stone Provincial Park, Alberta. Photos: Figure 2, RGF; Figure 3, DAWL.

deposited in the Invertebrate Collection of the Royal British Columbia Museum (RBCM), Victoria, British Columbia, Canada. Catalogue numbers of these vouchers are documented in Table 1.

RESULTS

We found four species of terrestrial snails, belonging to four families at the five sampled sites in Writing-on-Stone Provincial Park. Altogether we collected 119 specimens (Table 1). One sample (Site 3) had 59 individuals or half (49.6%) of all the specimens found.

Phylum Mollusca
Class Gastropoda
Clade Pulmonata
Family Succineidae

Succineid genus and species undetermined (Figure 4)

Four specimens of small succineids, one from each of four sites, were found (Table 1). Most, if not all specimens, are likely immature; the largest specimen (shell length 4.65 mm) is figured.

The family Succineidae is a taxonomically difficult group represented by five genera in Canada (Grimm et al. 2010). Most likely, our specimens belong to the genus *Mediappendix* (or genus *Catinella*, subgenus *Mediappendix*). However, genera are best distinguished by characters of the reproductive system, species are poorly known and identification is difficult, and our specimens remain unidentified. Animals were not preserved for anatomical study and identification to genus is uncertain.

Family Valloniidae

Vallonia gracilicosta Reinhardt, 1883 (Figure 5)

Vallonia gracilicosta Reinhardt (1883): 42. — Pilsbry (1948): 1028; Forsyth (2004): 49.
Vallonia gracilicosta gracilicosta — Gerber (1996): 111.
Vallonia albula Sterki (1893): 263. — Pilsbry (1948): 1031.
Vallonia gracilicosta albula — Gerber (1996): 113.

This species was collected at four sites (Table 1).

The development of a thickened lip serves to distinguish adult specimens of *Vallonia gracilicosta* from *V. cyclophorella* Sterki, 1892. Part of the material examined consisted of immature individuals that lack a final, outwardly flared peristome and internal, opaque, white rib-like callus thickening of the lip. We could not identify these immature specimens with certainty. However, because they were associated with other fully developed specimens they are believed to be the same species. *Vallonia gracilicosta* differs from *V. costata* (Müller, 1774) by the greater number of sculptural ribs and absence of spiral lines on the embryonic whorls.

Gerber (1996) recognized two subspecies, *V. gracilicosta gracilicosta* and *V. gracilicosta albula*, based on subtle but variable and over-lapping conchological differences. We did not identify our material to subspecies.

Family Pupillidae

Pupilla blandii Morse, 1865 (Figure 6)

Pupilla blandii Morse (1865): 211.
Pupilla blandi [*sic*] — Pilsbry (1948): 929; Nekola et al. (2010): 13, (2014).

This species was found in three litter samples (Table 1).

Pilsbry (1948), Nekola and Coles (2010) provided keys to and descriptions of *Pupilla* species. The traditional means to separate *P. blandii* from other species uses the number and placement of tooth-like structures (variously called folds, denticles or teeth) within the aperture and development of a ridge on the last whorl behind the lip (the crest); there is a more-or-less prominent denticle deep inside the aperture (usually termed "palatal") as well as columellar and parietal denticles, and the crest is pale-coloured. The palatal fold is often elongate, but this elongation is difficult to see in our material, or for that matter, in some of the specimens figured by Pilsbry (1948; especially fig. 502(1), p. 930). Recently however, Nekola et al. (2014) have revised *Pupilla* spp. using DNA-sequence data and found that both of these characters are variable. Our specimens are identified as *P. blandii*, fitting both the

traditional concept of the species and the new concept having a broader range of variation.

There were many juvenile and sub-adult shells in our collections; these have not yet developed the denticles within the aperture.

Family Discidae

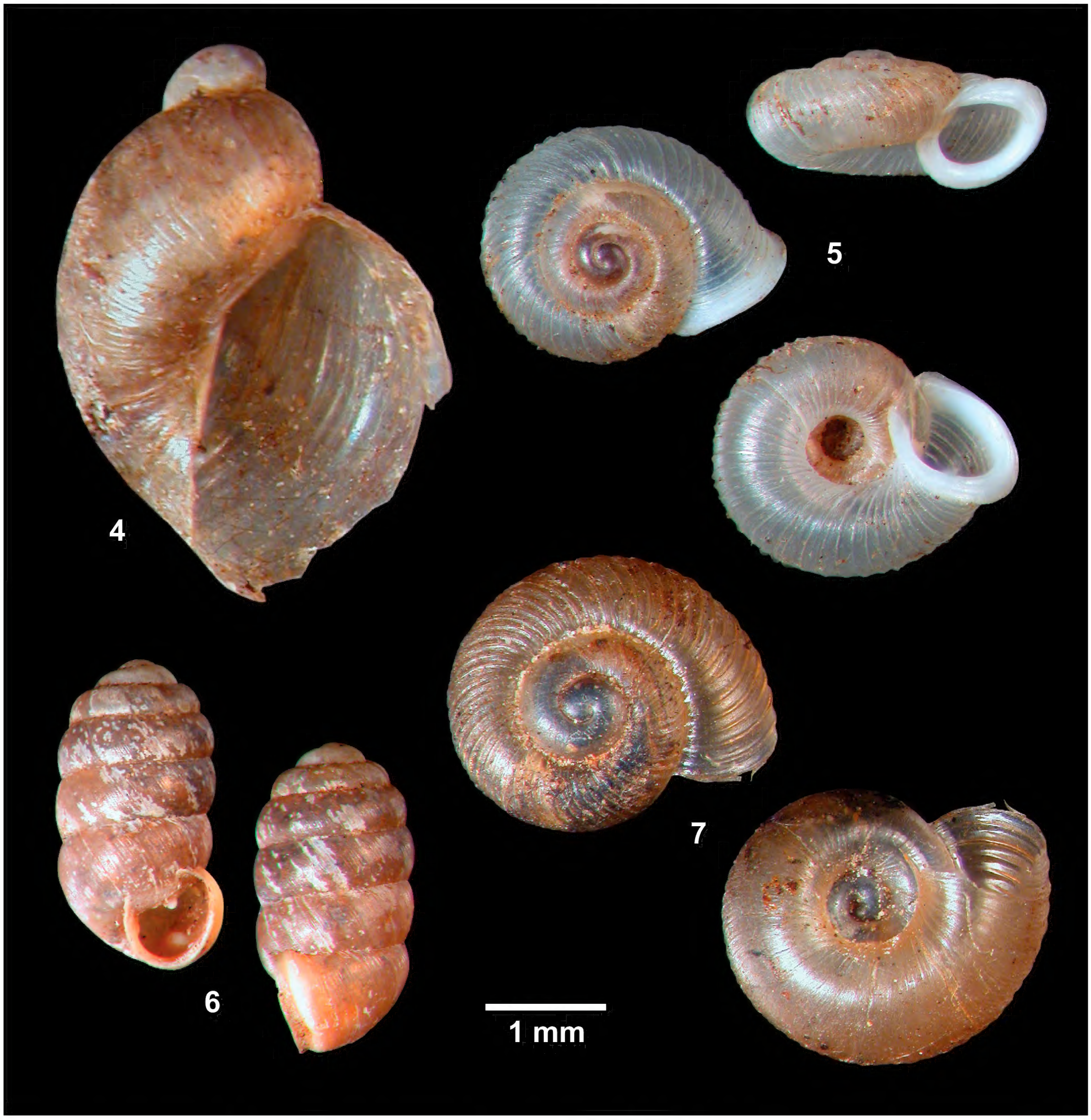
Discus shimekii (Pilsbry, 1890) (Figure 7)
Zonites shimekii Pilsbry (1890): 3.
Discus shimeki [*sic*] — Pilsbry (1948): 617.
Discus shimekii — Forsyth (2004): 80.

This species was collected at one site only (Table 1), but all specimens were immature. The largest specimen measured 2.75 mm wide (Figure 6).

Although all specimens were immature, the absence of any strong ribs on the lower (basal) surface of the shell indicates they are *D. shimekii* and not *D. whitneyi* (Newcomb, 1864).

DISCUSSION

Although our search effort was temporally and spatially limited, our results confirms our assumption



Figures 4-7. Land snails from Writing-on-Stone Provincial Park, Alberta, Canada. **4**: unidentified succineid (damaged), RBCM 014-00218-002 (Site 5). **5**: *Vallonia gracilicosta*, RBCM 014-00218-001 (Site 5). **6**: *Pupilla blandii*, RBCM 014-00215-001 (Site 2). **7**: *Discus shimekii* (immature), RBCM 014-00215-003 (Site 2). Scale bar = 1 mm.

that the terrestrial molluscan fauna in Writing-on-Stone Provincial Park is highly impoverished.

Vallonia gracilicosta was the most common species in terms of number of individuals (59 or 49.6%). Species of *Vallonia* are drought tolerant, often living in hot, dry biomes. They are also frequently associated with base-rich habitats. In Alberta, *Vallonia gracilicosta* is widespread in the foothills of the Rocky Mountains as well as in the prairie and parkland of the central part of the province (R. Forsyth, unpublished data).

Pupilla blandii and *Discus shimekii* tied as the second-most common species (28 individuals or 23.5% each), but *P. blandii* was found at three of the five sites, whereas *D. shimekii* was found at a single site (Site 2). *Pupilla blandii* has been reported in the literature from Alberta on just a few separate occasions, although it seems most likely that there is material in collections that is mislabelled as *P. muscorum* (Linnaeus, 1758), or perhaps other taxa. The habitat of *P. blandii* in Canada was previously undescribed in the malacological literature. Taylor (1895) first recorded *P. blandii* from drift of the Red Deer River, ≥350 km north of our sites; the distance can only be approximated due to the vagueness of the earlier locality. Although Dall (1905) and Pilsbry (1948) repeated Taylor's record, specimens were neither figured nor described, and presumably, most of his collection became mixed and was discarded (Drake 1963). Recently, using molecular data, Nekola et al. (2014) identified one record each from Alberta and Saskatchewan as *P. blandii;* the closest, at Irvine, Alberta, is ca. 140 km northeast of our sites. We have also collected *P. blandii* near Rosebud, Alberta, ca. 255 km to the north-northwest. We predict that this species will be found to be the common species throughout the Canadian prairies.

Discus shimekii is a species most commonly associated in Alberta with forests and aspen groves of the Rocky Mountain Foothills, Cypress Hills, and the parklands of central Alberta (R. Forsyth, unpublished data). Although previously recorded from upland areas of the Great Plains (i.e., the Cypress Hills; Forsyth and Lepitzki, in preparation), it was a surprise to find this species at Writing-on-Stone Provincial Park.

Single shells of the unidentified succineid were found at four sites. Although often regarded as wetland snails, some succineids are tolerant, or perhaps specialists, of xeric habitats.

Nearly all studies of the land snail fauna of Alberta have focused on more productive areas of the Rocky Mountain Foothills and Cypress Hills, as well as the Parklands of Central Alberta. Our study, although spatially and temporally restricted, is one of the few surveys of terrestrial molluscs from the xeric Plains of southern Alberta. Although constrained to a small area and suboptimal habitats in the badlands on the north side of the Milk River, we still managed to find terrestrial snails at all but one of our sites surveyed. These are the first records of any molluscs from Writing-on-Stone Provincial Park. Further investigations within the park could look at areas on the south side of the Milk River, which have more extensive areas of trees, shrubs, and other vegetation.

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